

# **1998 ANNUAL REPORT**

## **WATER QUALITY MANAGEMENT PROGRAM**

### **MISSOURI RIVER REGION LAKE PROJECTS**

#### **1. INTRODUCTION**

##### **a. Authorization**

This report summarizes the Water Quality Management Program for Corps lake projects within the boundaries of the Northwestern Division, Missouri River Region (MRR). It outlines the program objectives, describes ongoing water quality management activities, organizational and laboratory capabilities, major water quality problems, special studies and significant activities of 1998. This report is prepared in accordance with reporting requirements outlined in ER 1110-2-8154.

##### **b. Objectives**

The MRR and its field offices, the Omaha (NWO) and Kansas City (NWK) Districts, have established the following objectives for management of the Division Water Quality Program:

(1) Insure the impounded waters and releases from each lake project are of suitable quality for the established project uses.

(2) Establish base line conditions by defining pre-project (pre-impoundment) and post-project water quality conditions at each lake project.

(3) Determine if project waters are in compliance with applicable state and Federal water quality standards.

(4) Quantitatively identify and assess the magnitude of existing and potential water quality problems associated with project waters. Detect changes over time which may be either beneficial or degrading.

(5) Study special problems or develop criteria for such solutions as structural modification or modification of reservoir regulation procedures aimed at controlling or enhancing environmental conditions and meeting water quality objectives.

(6) Provide an understanding of project conditions to facilitate coordination with state agencies in regard to implementing watershed pollution control.

(7) Maintain an adequate water quality monitoring program for the purpose of achieving the above stated objectives.

### c. Summary of Significant Problems

Water quality problems identified in Omaha District projects during 1998 include pesticide and fertilizer contamination from agricultural practices, storm water run-off from urbanization especially during construction, sediment and nutrient inputs to the lakes, contaminants in fish tissue and shoreline erosion. Details of these problems are discussed in section 4, .Water Quality Issues and Problems in MRR.. Following is a summary of significant problems identified in the Omaha District.

Shoreline erosion is prevalent at all Omaha District projects. The erosion destroys littoral zone habitat, decreases light penetration, decreases lake depth all of which in turn impact the ecology, chemistry and recreational longevity of the lake.

Pesticides and mercury continue to be detected in Omaha District projects and both have been detected in fish tissue in the Zorinsky, Wehrspann, Garrison, Bowman-Haley, Pipestem, and Audubon Projects. Polychlorinated biphenyls (PCBs) and dieldrin have also been detected in tissue taken from fish collected in both the Salt Creek and Papillion Creek. Although these creeks are not Corps of Engineer (COE) managed the contaminants in these streams may have passed through COE projects

Extensive urbanization in the basins of tributary reservoirs has caused problems with excessive sediment, nutrients and other pollutant inputs. Cherry Creek, Chatfield, Bear Creek, Holmes, Zorinsky, Wehrspann, Glenn Cunningham and Standing Bear lakes are experiencing urbanization associated problems.

The Old Williston Landfill Area, located on the Garrison Project, is presently undergoing ground water and sediment monitoring. The City of Williston, North Dakota, is conducting the ground water and sediment monitoring while the Omaha District is conducting water sampling in the Little Muddy River adjacent to the site. 1999 is the final year of the study; review of the data by the North Dakota Department of Health will determine if continued sampling is necessary.

## 2. ORGANIZATION AND COORDINATION

### a. Organization and Assigned Responsibilities

The Omaha District is responsible for the implementation of the Water Quality Management Program at the Corps lake projects located within the district boundaries. The MRR office provides policy guidance and monitors the overall Water Quality Management Program. The Waterways Experiment Station Chemistry and Materials Quality Assurance Laboratories (CMQAL) performs water quality analyses for both the Omaha and Kansas City Districts and is responsible for technical supervision of water analyses performed at district, project and commercial laboratories. The CMQAL has established and maintains a laboratory quality control program. Engineering organizational elements in the district offices are responsible for the water quality

program, although the activities are coordinated with Operations and Planning elements. A biologist and a hydrologic technician coordinate the water quality sampling program in the Omaha District. A limnologist coordinates water quality problems, data analysis and non-routine monitoring. The following table provides further staffing information:

<b>TITLE</b>	<b>GRADE</b>	<b>YEARS OF EXPERIENCE</b>	<b>AREAS OF EXPERTISE</b>
Biological Aide (co-op)	7	0	General biological study
Hydrologic Technician	9	3	STORET data entry
Biologist	11	14	Sample collection
Limnologist	12	33	Limnology, Chemistry, Aquatic ecology, Ichthyology, Phycology, Environmental remediation, Wetlands

Additionally, approximately 30 area personnel are involved in sample collection and mainstem release water monitoring in the water quality monitoring program.

Those Operation Division elements assigned with this responsibility are as follows:

<b>PROJECT OFFICE</b>	<b>STATE</b>
Fort Peck	Montana
Garrison	North Dakota
Oahe	South Dakota
Big Bend	South Dakota
Fort Randall	South Dakota
Gavins Point	South Dakota
Rocky Mountain Area	Colorado

b. Coordination with Others

Water quality activities conducted jointly or under contract with other groups or agencies are as follows:

<b>AGENCY/CONTRACTOR</b>	<b>PROJECT</b>	<b>TYPE OF INVESTIGATION</b>	<b>TYPE OF WORK</b>
USGS	Fort Peck	Surveillance	Sample Collection
USGS	Garrison	Surveillance	Sample Collection
Wayne Kromarek, Contractor	Bowman-Haley	Surveillance	Sample Collection

Routine coordination of sample collection and analyses is conducted with other state organizations within the Omaha District to avoid duplication of sampling effort.

### 3. WATER QUALITY ACTIVITIES IN MRR

#### a. Investigations

Three types of investigations are performed on reservoir projects: pre-impoundment, surveillance and comprehensive investigations. A pre-impoundment investigation is made before completion of a project to establish base line conditions. A surveillance investigation is an annual post-project investigation consisting of fixed station sample collection and analysis of basic water quality parameters to establish water quality trends. A comprehensive investigation is an extensive post-project investigation conducted at several locations in the lake to obtain a more thorough understanding of reservoir water quality. Additional water quality parameters are analyzed if a specific problem is being investigated and to obtain a comprehensive evaluation of the present project conditions.

Field investigations conducted during 1998 are as follows:

(1) Pre-impoundment Investigations - none.

(2) Surveillance Investigations

<b>MAINSTEM PROJECTS</b>		<b>TRIBUTARY PROJECTS</b>	
Fort Peck	Pipestem	Standing Bear	Branched Oak
Garrison	Bowman-Haley	Zorinsky	Pawnee
Oahe	Cherry Creek	Glenn Cunningham	Stagecoach
Fort Randall	Bear Creek	Lake Audubon	Olive Creek
Gavins Point	Coldbrook	Lake Pocasse	Wagon Train Lake
Big Bend	Yankton	East Twin	West Twin
	Chatfield	Wehrspann	Yankee Hill
	Conestoga	Bluestem	Holmes

### 3. COMPREHENSIVE INVESTIGATIONS

b. Special Studies - none

### 4. WATER QUALITY ISSUES AND PROBLEMS IN MRR

#### a. Issues and Problems of 1998

(1) Pesticides and Heavy Metal Contamination. Pesticide application throughout the Missouri River basin has affected most Omaha District projects. Pesticides detected in the past five years include atrazine, alachlor, diazinon, dachthal, metolachlor, dieldrin, simazine, metribuzin, propachlor, dicamba and trifluralin. Not all the listed pesticides are covered by Federal criteria or state water quality standards.

Due to the widespread occurrence of pesticides, bioaccumulation of some pesticides in tissue of aquatic organisms is a potential threat to all consumers of these organisms. A 1986 fish tissue analyses program evaluated the extent of bioaccumulation of pesticides and metals in fish of the Salt Creek and Papillion Creeks Lake projects. Results of those tests show that chlordane, dieldrin, DDT and several metals were detectable, but below the level set by the Food and Drug Administration (FDA) to limit or restrict human consumption. Similar studies have not been undertaken to update this information.

Fish tissue collected from Zorinsky and Wehrspann Lakes by the Nebraska Department of Environmental Quality in the past three years has exceeded FDA recommended human consumption limits based on mercury levels in the tissue. The Nebraska Department of Health (NEDH) has issued an advisory against consumption of fish caught in these impoundments. Although not COE impoundments, the NEDH has issued advisories on eating fish caught in the Salt Creek from Lincoln to the Platte River.

Tissue collected in the Salt Creek has contained both poly chlorinated biphenyls (PCB) and dieldrin. The levels of these toxins were high enough to issue a consumption advisory.

The following sites, tested by the NEDH, have shown no fish contamination that would warrant a consumption advisory under Nebraska protocol: Branched Oak, Bluestem, Conestoga, Holmes, Olive Creek, Pawnee, Wagon Train, Yankee Hill, Glen Cunningham, and Lewis and Clark Lake.

The U.S. Fish and Wildlife Service (USFWS) in Pierre, South Dakota, collected blood, liver, and muscle tissue from shovelnose sturgeon and walleye from the Missouri River near Pierre and Yankton, South Dakota, in spring 1994. The tissue was to be tested for 23 elements and reproductive hormones. Results of the testing may be combined with data from similar studies in Montana and North Dakota.

Similar analysis was performed on blue suckers and paddlefish collected from the Missouri River in 1993. These results may be combined with the 1994 data as well.

The USFWS has also conducted studies concerning fish collected in irrigation return water. The studies will measure heavy metals and organochlorine pesticides in the fish tissue. Data were collected in 1996 in Lake Pocasse and in 1997 in the Cheyenne arm of Lake Oahe. Results of the 1996 testing are being combined with similar studies conducted in Colorado, Utah, Montana, North and South Dakota, Kansas and Nebraska. A report of the findings should be published in late 1999.

The Oglala Sioux Tribe and the Bureau of Reclamation collected fish tissue in the upper Cheyenne River near Angostura, South Dakota, in 1998. The tissue will be analyzed for heavy metals and pesticides.

The North Dakota Department of Health and Consolidated Laboratories (NDDHCL)

in Bismarck, North Dakota, has issued an advisory on consumption of fish caught in some streams and lakes in North Dakota. Bowman-Haley Lake and Lake Sakakawea are included in the advisory. The detection of mercury in the fish fillets precipitated the advisory. The advisory was not intended to discourage anglers from eating fish, but offered advice on how fish caught in these impoundments could be eaten safely. Anglers are advised to consume small younger fish and release older fish. Additional analyses will be conducted by the NDDHCL and the advisory updated annually.

The NDDHCL had undertaken a study on mercury in fish tissue from Lake Sakakawea. The study involved the release of mercury from vegetation inundated by the 1993 flood. The study concluded that walleye, sauger and chinook salmon populations all demonstrated a significant increase in mercury content.

(2) Urbanization. Urbanization is on-going around many Omaha District reservoirs. Reservoirs with urbanizing watersheds include Cherry Creek, Chatfield, Bear Creek, Holmes, Zorinsky, Glen Cunningham, Standing Bear, and Wehrspann Lakes. Urbanization to a lesser degree is occurring at additional projects. Urbanization causes a variety of problems such as massive changes in hydrology associated with storm drainage, pollution, laying the land bare during construction, and encroachments.

Construction methods normally involve laying the land bare allowing sediment laden run-off to impact nearby streams and lakes. Best Management Practices (BMP) to minimize construction associated sedimentation damages are rarely used effectively. Methods of minimizing construction impact include; temporary sediment ponds, staging construction so that large areas are not denuded, using hay bales, silt curtains, etc. Efforts should be made to prevent off-project construction sedimentation from causing on-project impacts. This could be accomplished by working with developers and appropriate state, city, or county agencies.

Post construction problems are commonly associated with storm drainage and urban pollution. The conversion of grasslands or forests to roads, rooftops, sidewalks, and other water impervious surfaces make stream flows more variable and increases the frequency of high flow events. In addition, pollutants associated with urban drainage can cause severe impacts to downstream water bodies. Urban storm flows detrimental to receiving water can be permitted under the National Pollutant Discharge Elimination System thus requiring treatment. Storm sewer exits can be allowed on project lands provided detention in the form of ponds, swales, or wetlands exist on private property. A developer may be asked to construct a series of wetlands to slow downhill flows and provide time for bacterial die-off, chemical degradation, reduced flow rates, and sediment fall out.

(3) Sedimentation Sedimentation is the process which ultimately eliminates the usefulness of reservoirs. In the design and construction of reservoirs, the COE will commonly allow for additional volume to accommodate inflowing sediment. The inflowing sediment destroys the reservoirs ecology, fisheries, benthos, and in general makes the reservoir less valuable than originally intended. The reservoir will suffer severe

ecological damage long before a volume function such as flood control is impacted. The influx of sediment eliminates fish habitat, adds nutrients, destroys aesthetics, and decreases biodiversity. Sediment traps should be an integral part of any reservoir project. Closely working with the project sponsors in an effort to manage sediment input would ultimately prolong reservoir life. Wetlands could be constructed at the upper end of a reservoir either upstream of the reservoir, or by taking a portion of the reservoir's upper end, making a wetland. It is much more cost effective to keep the sediment out of the reservoir than to renovate the reservoir after the damage is done.

(4) Shoreline Erosion. Shoreline erosion is a major problem occurring on nearly all reservoirs located in areas of erodible soils such as the Midwest. The Omaha District alone has over 6000 miles of reservoir shoreline of which between 70 and 90 percent is eroding. Some facilities have been protected, such as recreational and archaeological sites, but most of the shoreline continues to erode. Continued loss of the shoreline habitat (littoral zone) results in the loss of fishery habitat as well as loss of habitat for other biota such as aquatic vegetation and benthos. Past shoreline erosion efforts should be evaluated for effectiveness so that successes can be repeated and failures rejected. An "ad hoc" committee has been formed to resolve shoreline erosion problems.

b. Water Quality Classification

The water quality conditions in each project have been classified in accordance with the following criteria:

CLASS	CRITERIA
I	High Water Quality No Known Problems
II	Generally Good Water Quality: Minor or Suspected Problems
III	Continuing Water Quality Problems Requires Close Monitoring of Trends and Careful Examination of Problems

The following is a list of projects evaluated according to the above classifications.

(1) Class I: None

(2) Class II

Fort Peck	Chatfield	Garrison	Oahe
Big Bend	Fort Randall	Gavins Point	Audubon

Pipestem	Lake Pocasse	Lake Yankton	Coldbrook
Cottonwood Springs			

(3) Class III

Zorinsky	Standing Bear	Pawnee	Wehrspann
Yankee Hill	Glenn Cunningham	Stagecoach	Conestoga
Cherry Creek	Bowman-Haley	Holmes	Bluestem
Bear Creek	Branched Oak	East Twin	West Twin
Olive Creek	Wagon Train		

## 5. TECHNICAL ASSISTANCE TO OTHERS

A large part of the technical assistance to others consisted of aiding district elements. An increasing portion of the workload has been assisting outside agencies such as states, Natural Resource Districts or project sponsors with specific water quality problems. The following identifies assistance provided to various Corps elements and outside agencies.

a. Technical Assistance - Engineering Division.

1. Reviewed Section 1135 projects
2. Reviewed the Zorinsky Lake development proposals
3. Review of the Cherry Creek Drainage Plan
4. Assisted on the draw down portion of the Lake Sharpe Environmental Impact Statement. This involved a number of environmental problems such as sedimentation, loss of benthos, impacts to fisheries, and shoreline erosion
5. Developed an "ad hoc" committee with the approval of Operations Division to develop environmentally friendly methods of shoreline erosion control
6. Provided data on the Chatfield/Bear Creek Re-allocation study
7. Reviewed the Parker Road Drainage Master Plan
8. Worked on the Lower Platte Study and managed the water quality portion of the study including contracting
9. Worked with other COE elements on evaluating dredging test results
10. Worked with UNL on contracts for evaluating Salt Creek Lakes and researching problems for quantifying long term changes in reservoir chemistry, physics and biology

b. Technical Assistance - Operations Division.

1. Review and comment on the Chatfield Master Plan
2. Provide assistance to the Gavins Point Project on a proposed hog lot operation
3. Assisted the Missouri River Project Office to utilize tire bales as a shoreline erosion preventative measure as well as to provide littoral zone habitat fisheries



- production
4. Assisted numerous area offices on shoreline problems and evaluations of the effectiveness of their efforts
  5. Assisted the Bowman-Haley ranger with fishery problems involving fish ladders and the disappearance of some fishes in the area of a constructed wetland
  6. Provided alternatives to rock for purposes of halting shoreline erosion to various project offices
  7. Provided assistance involving the use of scrap tires for fishery management and shoreline prevention
  8. Developed life histories for fishes potentially impacted by the Spring Creek diversion
  9. Provided information on agitation dredging
- c. Technical Assistance - Real Estate Division.
1. Assisted Real Estate Division and developers to resolve sedimentation problems associated with construction at Chatfield Reservoir (Chatfield Green Development)
- d. Technical Assistance - Other Corps Elements.
1. Assisted area offices pertinent to tribal efforts to create water quality standards.
  2. Water quality personnel are members of several groups and committees including a COE Field Review Group.
  3. Assisted OCE on a variety of COE efforts such as reviewing Section 1135 projects, handbooks and other reports and in updating the Water Quality Engineering Manual
  4. Assisted the Office of Council on the potential Black Hills Homestake mining problem and in reviewing and providing input on the Stream Corridor Restoration Handbook
  5. Assisted OCE and WES on a variety of new environmental programs and efforts such as Ecosystem Management and Restoration Resources Programs and the Roadmap Conference to provide environmental direction to COE efforts
  6. Worked with a variety of COE elements on the use of tires for fishery habitat and for stopping shoreline erosion
  7. Attended Corps committee on Water Quality Meetings and Field Review Group meetings
  8. Worked on assessing and guiding the COE Research and Development program
  9. Worked with WES in developing environmentally friendly methods and guiding research efforts for submittal to district and division offices
  10. Assisted Emergency Management on the Nishnabotna study
  11. Provided input at OCE meetings pertinent to new environmental missions
  12. Provided information and expertise at OCE meeting involving new COE environmental initiatives

e. Assistance to Outside Agencies.

1. Assisted the United States Geological Survey (USGS) as a member of the National Water Quality Assessment (NAWQA) Liaison Committee on matters pertaining to the Platte River
2. Assisted the Nebraska Game and Parks Reservoir Planning Team in monitoring shoreline erosion rates and efforts at some Papio and Salt Creek Lakes
3. Assisted the City of Omaha on a Zorinsky Lake Watershed Development Plan
4. Assisted the State of Nebraska in developing and maintaining their Non-Point Pollution Source Program
5. Assisted the Environmental Protection Agency on their Index of Watershed Indicators efforts
6. Assisted the Nebraska Department of Environmental Quality to protect water sources for numerous cities
7. Worked with the Nebraska Game and Parks Commission in completing a report on shoreline erosion at the Salt Creek Lakes
8. Worked with the State of Nebraska on resolving fish tissue pollutant problems in Nebraska waters
9. Provided the City of Omaha with environmentally friendly methods of dealing with sedimentation and shoreline erosion within the Zorinsky Lake watershed
10. Worked with Boystown in evaluating their reservoir problems and identifying solutions and obtaining financing
11. Assisted the State of Nebraska in developing and implementing the Source Water Assessment Program for Nebraska
12. Worked with the Nebraska Department of Environmental Quality in resolving the sewage treatment problem in Salt Creek
13. Worked with the State of Nebraska in evaluation Non-Point Source projects. This involved evaluation which in turn resulted in the awarding of millions of dollars for environmental projects
14. Worked with the State of Nebraska in resolving fish tissue contaminant problems
15. Worked with the State of Nebraska and area offices in attempting to resolve odor problems associated with the development of hog lots
16. Worked on shoreline erosion problems on Salt and Papio Creek Lakes. Provided information to project office and Nebraska Game and Parks

f. Water Quality Sample Collection Training. The Omaha District Water Quality Unit utilizes approximately 30 area personnel for water quality sample collection and support of the continuous recording water quality monitors. Periodic training of new personnel and refresher training is necessary to maintain the present quality of field sampling. The following Projects were provided with training:

1. Fort Peck
2. Oahe
3. Garrison
4. Tri-Lakes Area Office

## 6. POSITIVE ACTIONS

As a result of the water quality unit's involvement, a variety of efforts to improve lake quality are being accomplished. These efforts improve water quality and recreation and have the potential to extend the recreational life of the lake. Examples of positive actions include:

a. Major programs are on-going at Cherry Creek, Zorinsky, and Wehrspann Lakes. These programs are aimed at maintaining and improving water quality and reservoir ecosystems.

b. Water quality personnel are involved in many shoreline erosion prevention projects and wetland creation projects which will benefit water quality, aesthetics, fisheries, and recreation. An "ad hoc" committee was formed to involve Planning, Operations, and Engineering in the resolution of shoreline erosion problems.

c. The following ideas have been provided by water quality personnel and have been initiated or are being considered for action:

(1) Utilizing riprap in new ways to increase habitat diversity and decreasing the cost of riprap per linear foot.

(2) Resolving shoreline erosion problems using sound ecological methods.

(3) Worked with state agencies on warning fishermen about reservoirs with contaminants in fish flesh.

## 7. GOALS AND RECOMMENDATIONS

The following actions are recommended to improve and maintain the overall water quality program.

a. Maintain a balanced Water Quality Management Program that is responsive to project and agency needs.

b. Assist Operations elements with the development of action plans for dealing with emergency situations such as fish kills or algal problems and assist Real Estate with easement problems pertinent to water quality applications.

c. Expand on the use and training of project personnel to collect water quality data.

d. Maintain a viable Water Quality Data Collection Program to determine if project waters are in compliance with applicable State water quality standards.

e. Cooperate with state and Federal agencies in evaluation of stream flow needs and resolving problems beyond Corps management boundaries to insure beneficial usage of impounded waters.

f. Assist other district elements in the assessment of potential of actual water quality issues.

g. Monitor algal problems with emphasis on public health threats and train area personnel in the identification and collection of suspected toxic material.

h. Identify and resolve point source pollution problems such as inadequate sewage treatment.

i. Maintain a viable monitoring program at all the projects in accordance with ranked priorities, concentrating more effort on Class III projects, as identified in 4.b.

j. Facilitate coordination with state agencies in regard to implementing water shed pollution control by providing an understanding of project conditions.

### WATER QUALITY PROBLEMS AND ISSUES IN MRR LAKES 1998 OMAHA DISTRICT

Project	Algal Blooms	Fish Kills	Actual/Potential Problem Areas*	State Standard Exceedance
Fort Peck, Montana Missouri River Main Stem	None Reported	None Reported	Coal and Oil Development, Algal Blooms	<b>INFLOWS:</b> none identified <b>RESERVOIR:</b> dissolved oxygen, chlordane, iron, arsenic <b>RELEASES:</b> arsenic
Lake Sakakawea, North Dakota Missouri River Main Stem	Yes	None Reported	Oil Drilling, Strip Mining, Algal blooms, Low Dissolved Oxygen, Atrazine, Metribuzin	<b>INFLOWS:</b> arsenic <b>RESERVOIR:</b> dissolved oxygen, phosphorus, lead, arsenic, iron <b>RELEASES:</b> none identified
Lake Audubon, North Dakota Subimpoundment Lake Sakakawea	Yes	None Reported	Winter Kills Atrazine, Alachlor, Metribuzin	<b>IMPOUNDMENT:</b> phosphorus, arsenic, dissolved oxygen, lead, sulfate, iron, manganese
Lake Oahe, South Dakota Missouri River Main Stem	None Reported	None Reported	Agricultural runoff containing pesticides and other contaminants, Bioaccumulation of Mercury Metribuzin	<b>INFLOWS:</b> none identified <b>RESERVOIR:</b> dissolved oxygen, pH, arsenic, iron, manganese <b>RELEASES:</b> arsenic
Lake Pocasse, South Dakota Subimpoundment, Lake Oahe	None Reported	None Reported	Agricultural runoff Winter kills	<b>IMPOUNDMENT:</b> pH
Lake Sharpe, South Dakota Missouri River Main Stem	None Reported	None Reported	Agricultural runoff	<b>INFLOWS:</b> none identified <b>RESERVOIR:</b> dissolved oxygen, pH, arsenic

Project	Algal Blooms	Fish Kills	Actual/Potential Problem Areas*	State Standard Exceedance
				<b>RELEASES:</b> arsenic, pH, atrazine
Lake Francis Case, South Dakota Missouri River Main Stem	None Reported	None Reported	Intrusion of the White River Delta	<b>INFLOWS:</b> atrazine <b>RESERVOIR:</b> pH, dissolved oxygen, sulfate <b>RELEASES:</b> pH, sulfate
Lewis and Clark, South Dakota Missouri River Main Stem	None Reported	None Reported	Emergent aquatic vegetation Metribuzin	<b>INFLOWS:</b> sulfate <b>RESERVOIR:</b> dissolved oxygen, pH, arsenic, iron, sulfate, manganese, atrazine <b>RELEASES:</b> pH, arsenic, dissolved oxygen, sulfate, iron, atrazine
Lake Yankton, South Dakota Forebay of Gavins Point	None Reported	None Reported	Schistosome Dermatitis Metribuzin, Treflan, Simazine	<b>IMPOUNDMENT:</b> dissolved oxygen, pH, sulfate, manganese
Bowman-Haley, North Dakota Tributary	Yes	None Reported	Algal blooms Atrazine, Metribuzin	<b>INFLOWS:</b> phosphorus, boron, pH, sulfate, arsenic, iron, manganese <b>RESERVOIR:</b> phosphorus, sulfate, arsenic, dissolved oxygen, pH, iron, manganese <b>RELEASES:</b> phosphorus, sulfate, arsenic, sulfate, iron, manganese
Pipestem, North Dakota Tributary	Yes	None Reported	Winter kills	<b>INFLOWS:</b> phosphorus, dissolved oxygen, pH, arsenic, sulfate, iron, manganese <b>RESERVOIR:</b> phosphorus, dissolved oxygen, arsenic, iron, manganese, pH <b>RELEASES:</b> phosphorus, arsenic, sulfate, iron, manganese
Cottonwood Springs, South Dakota	None Reported	None Reported		<b>IMPOUNDMENT:</b> unmeasured
Cold Brook, South Dakota Tributary	None Reported	None Reported		<b>INFLOWS:</b> none identified <b>RESERVOIR:</b> arsenic, pH, dissolved oxygen <b>RELEASES:</b> arsenic
Cherry Creek, Colorado Tributary	None Reported	None Reported	Rapid urbanization Winter kills Bacterial contamination	<b>INFLOWS:</b> iron, pH, arsenic, manganese <b>RESERVOIR:</b> dissolved oxygen, phosphorus, iron, sulfate, pH, arsenic, manganese <b>RELEASES:</b> pH, iron, manganese
Bear Creek, Colorado Tributary	None Reported	None Reported	Bacterial contamination Urbanization Low dissolved oxygen Winter kills	<b>INFLOWS:</b> sulfate, iron, pH, manganese, copper, lead <b>RESERVOIR:</b> pH, iron, manganese, sulfate, copper, lead <b>RELEASES:</b> iron, manganese
Chatfield, Colorado Tributary	None Reported	None Reported	Urbanization, Potential Contamination from Martin Marietta, Low dissolved oxygen,	<b>INFLOWS:</b> phosphorus, iron, pH, manganese, total alkalinity, arsenic, copper, lead <b>RESERVOIR:</b> dissolved oxygen, phosphorus, pH, iron, manganese, lead <b>RELEASES:</b> phosphorus, pH, iron, manganese, lead
Pawnee Lake, Salt Valley Reservoir Nebraska Tributary	None Reported	None Reported	Bioaccumulation of metals and pesticides, Algal toxins, Sedimentation, Shoreline erosion, Treflan	<b>INFLOWS:</b> arsenic, iron, silver, atrazine, manganese <b>RESERVOIR:</b> dissolved oxygen, arsenic, atrazine, iron, H, arsenic, manganese <b>RELEASES:</b> arsenic, atrazine, iron, manganese
Olive Creek lake, Salt Valley Reservoir	None	None	Bioaccumulation of metals and	<b>INFLOWS:</b> none identified

Project	Algal Blooms	Fish Kills	Actual/Potential Problem Areas*	State Standard Exceedance
Nebraska Tributary	Reported	Reported	pesticides, Algal toxins, Sedimentation, Shoreline erosion Banvel, Treflan, Metolachlor, Alachlor	<b>RESERVOIR:</b> dissolved oxygen, arsenic, atrazine, iron, lead, cyanide, manganese <b>RELEASES:</b> cyanide
Yankee Hill Lake, Salt Valley Reservoir Nebraska Tributary	None Reported	None Reported	Bioaccumulation of metals and pesticides, Algal toxins, Shoreline erosion, Sedimentation, Metolachlor Alachlor, Treflan	<b>INFLOWS:</b> iron, atrazine, arsenic, manganese <b>RESERVOIR:</b> dissolved oxygen, arsenic, atrazine, iron, manganese <b>RELEASES:</b> atrazine, arsenic, iron, manganese
Wagon Train Lake, Salt Valley Reservoir Nebraska Tributary	None Reported	None Reported	Bioaccumulation of metals and pesticides, Algal toxins, Shoreline erosion, Sedimentation,	<b>INFLOWS:</b> manganese, iron, arsenic <b>RESERVOIR:</b> dissolved oxygen, arsenic, iron, manganese <b>RELEASES:</b> arsenic, iron, manganese
Holmes Lake, Salt Valley Reservoir Nebraska Tributary	None Reported	None Reported	Bioaccumulation of metals and pesticides, Algal toxins, Shoreline erosion, Sedimentation, BHC, Treflan, Ramrod, Metolachlor	<b>INFLOWS:</b> arsenic, iron, atrazine, manganese, copper, lead <b>RESERVOIR:</b> dissolved oxygen, arsenic, iron, atrazine, pH, manganese <b>RELEASES:</b> manganese, dissolved oxygen, arsenic, iron, atrazine
Blue Stem Lake, Salt Valley Reservoir Nebraska Tributary	None Reported	None Reported	Bioaccumulation of metals and pesticides, Algal toxins, Shoreline erosion, Sedimentation, Metolachlor, Banvel, Treflan, Alachlor	<b>INFLOWS:</b> dissolved oxygen, arsenic, iron, atrazine, cyanide, manganese <b>RESERVOIR:</b> dissolved oxygen, arsenic, iron, atrazine, manganese <b>RELEASES:</b> arsenic, iron, atrazine, cyanide, manganese
East Twin Lake, Salt Valley Reservoir Nebraska Tributary	None Reported	None Reported	Bioaccumulation of metals and pesticides, Algal toxins, Shoreline erosion, Winter kills, Sedimentation Alachlor, Treflan, Metolachlor	<b>INFLOWS:</b> none identified <b>RESERVOIR:</b> dissolved oxygen, arsenic, atrazine, iron, cyanide, manganese <b>RELEASES:</b> atrazine, cyanide, manganese, iron
West Twin Lake, Salt Valley Reservoir Nebraska Tributary	None Reported	None Reported	Bioaccumulation of metals and pesticides, Algal toxins, Shoreline erosion, Winter kills, Sedimentation Metolachlor, Metribuzin, Alachlor	<b>INFLOWS:</b> none identified <b>RESERVOIR:</b> dissolved oxygen, arsenic, iron, manganese, atrazine <b>RELEASES:</b> releases are not made from West Twin Lake
Stagecoach Lake, Salt Valley Reservoir Nebraska Tributary	Yes	None Reported	Bioaccumulation of metals and pesticides, Algal toxins, Shoreline erosion, Sedimentation, Metolachlor, Treflan, Alachlor, Banvel, Metribuzin	<b>INFLOWS:</b> lead, arsenic, iron, manganese, atrazine <b>RESERVOIR:</b> dissolved oxygen, arsenic, atrazine, iron, lead, cyanide, manganese <b>RELEASES:</b> arsenic, iron, atrazine, cyanide, manganese
Conestoga Lake, Salt Valley Reservoir Nebraska Tributary	None Reported	None Reported	Bioaccumulation of metals and pesticides, Algal toxins, Shoreline erosion, Sedimentation, Metolachlor, Alachlor, Treflan	<b>INFLOWS:</b> arsenic, iron, manganese, atrazine <b>RESERVOIR:</b> dissolved oxygen, arsenic, atrazine, iron, manganese <b>RELEASES:</b> arsenic, atrazine, iron, manganese
Branched Oak Lake, Salt Valley Reservoir Nebraska Tributary	None Reported	None Reported	Bioaccumulation of metals and pesticides, Algal toxins, Shoreline erosion, Sedimentation, Banvel, Treflan, Metolachlor	<b>INFLOWS:</b> arsenic, atrazine, iron, manganese <b>RESERVOIR:</b> dissolved oxygen, arsenic, atrazine, lead, iron, arsenic, manganese <b>RELEASES:</b> iron, atrazine, manganese
Glen Cunningham Lake Papillion Creek Reservoir Nebraska, Tributary	Yes	None Reported	Bioaccumulation of metals and pesticides, Algal toxins, Sedimentation, Shoreline erosion, Oil	<b>INFLOWS:</b> arsenic, iron, atrazine, nitrate, manganese, selenium <b>RESERVOIR:</b> dissolved oxygen,

Project	Algal Blooms	Fish Kills	Actual/Potential Problem Areas*	State Standard Exceedance
			spills, Banvel, Treflan	arsenic, atrazine, iron, mercury, manganese <b>RELEASES:</b> iron, arsenic, manganese, atrazine
Standing Bear Lake Papillion Creek Reservoir Nebraska, Tributary	Yes	None Reported	Bioaccumulation of metals and pesticides, Algal toxins, Sedimentation, Shoreline erosion, Alachlor, Banvel, Treflan, Simazine	<b>INFLOWS:</b> arsenic, iron, atrazine, manganese, lead <b>RESERVOIR:</b> dissolved oxygen, atrazine, arsenic, pH, iron, lead, mercury, manganese <b>RELEASES:</b> iron, arsenic, manganese, atrazine
Wehrspann Lake Papillion Creek Reservoir Nebraska, Tributary	Yes	None Reported	Bioaccumulation of metals and pesticides, Algal toxins, Sedimentation, shoreline erosion, Banvel, Metribuzin, Metolachlor	<b>INFLOWS:</b> manganese, atrazine, arsenic, iron <b>RESERVOIR:</b> dissolved oxygen, arsenic, atrazine, mercury, iron, manganese <b>RELEASES:</b> dissolved oxygen, arsenic, atrazine, iron, manganese
Zorinsky Lake Papillion Creek Reservoir Nebraska, Tributary	Yes	None Reported	Bioaccumulation of metals and pesticides, Algal toxins, Sedimentation, Shoreline erosion, Metolachlor, Banvel, Metribuzin, Diazanone	<b>INFLOWS:</b> iron, atrazine, manganese, selenium, arsenic <b>RESERVOIR:</b> dissolved oxygen, arsenic, atrazine, iron, manganese, pH <b>RELEASES:</b> arsenic, atrazine, iron, manganese

\* This column contains pesticides detected in project waters for which state or Federal standards have not been developed.